

Double-decker Noise Modeling

**Capturing the reflection for the
Alaskan Way Viaduct**

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Presented By:



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Alaskan Way Viaduct

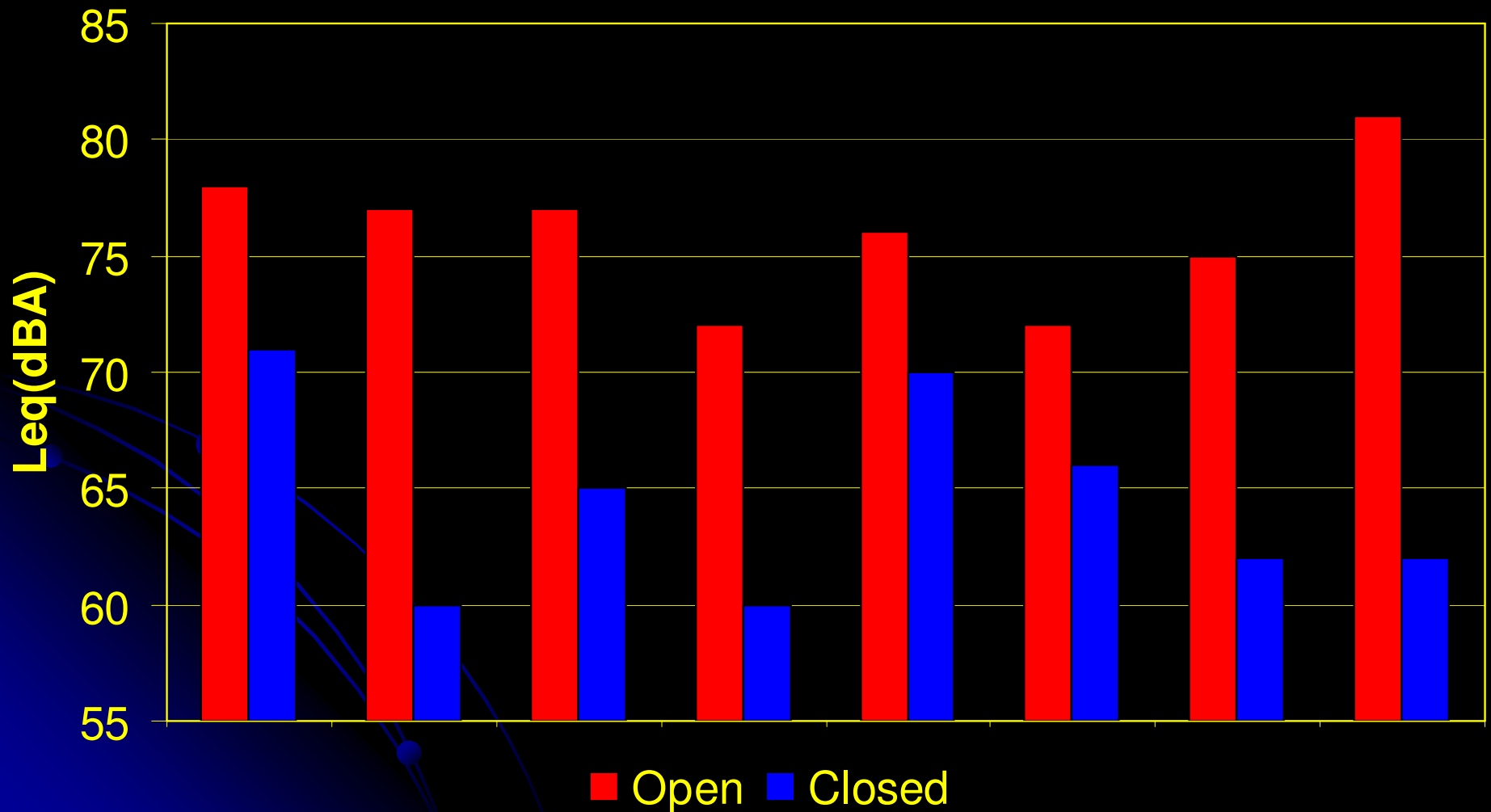


Study Vicinity – Seattle, WA



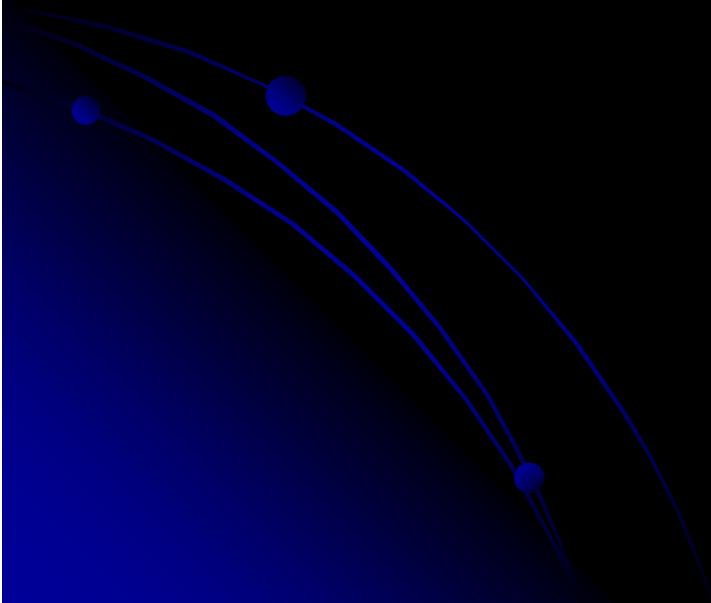
Alaskan Way Viaduct

Noise Measurements with Viaduct Open and Closed



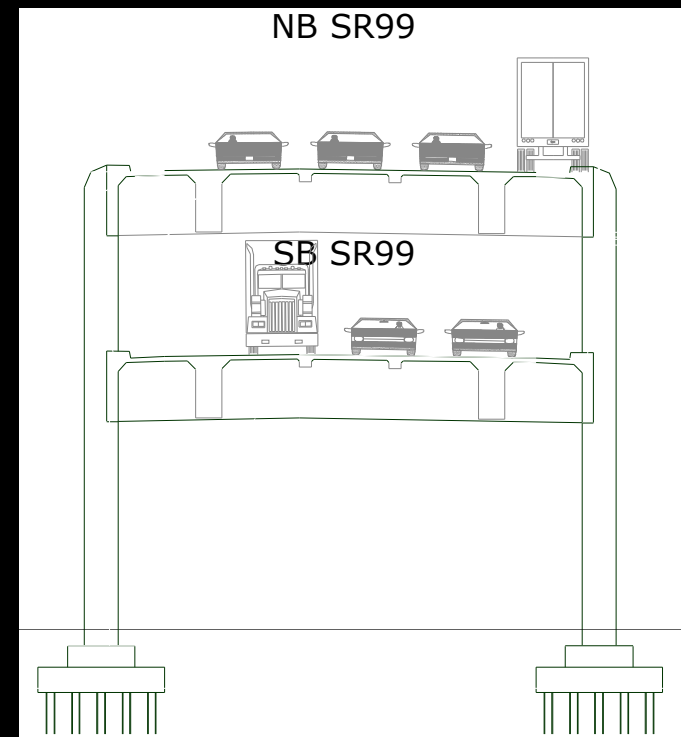
Noise Measurement Differences

- The average measured difference between closed and open was 12 dBA.
- The range of differences was from 6 to 19 dBA.

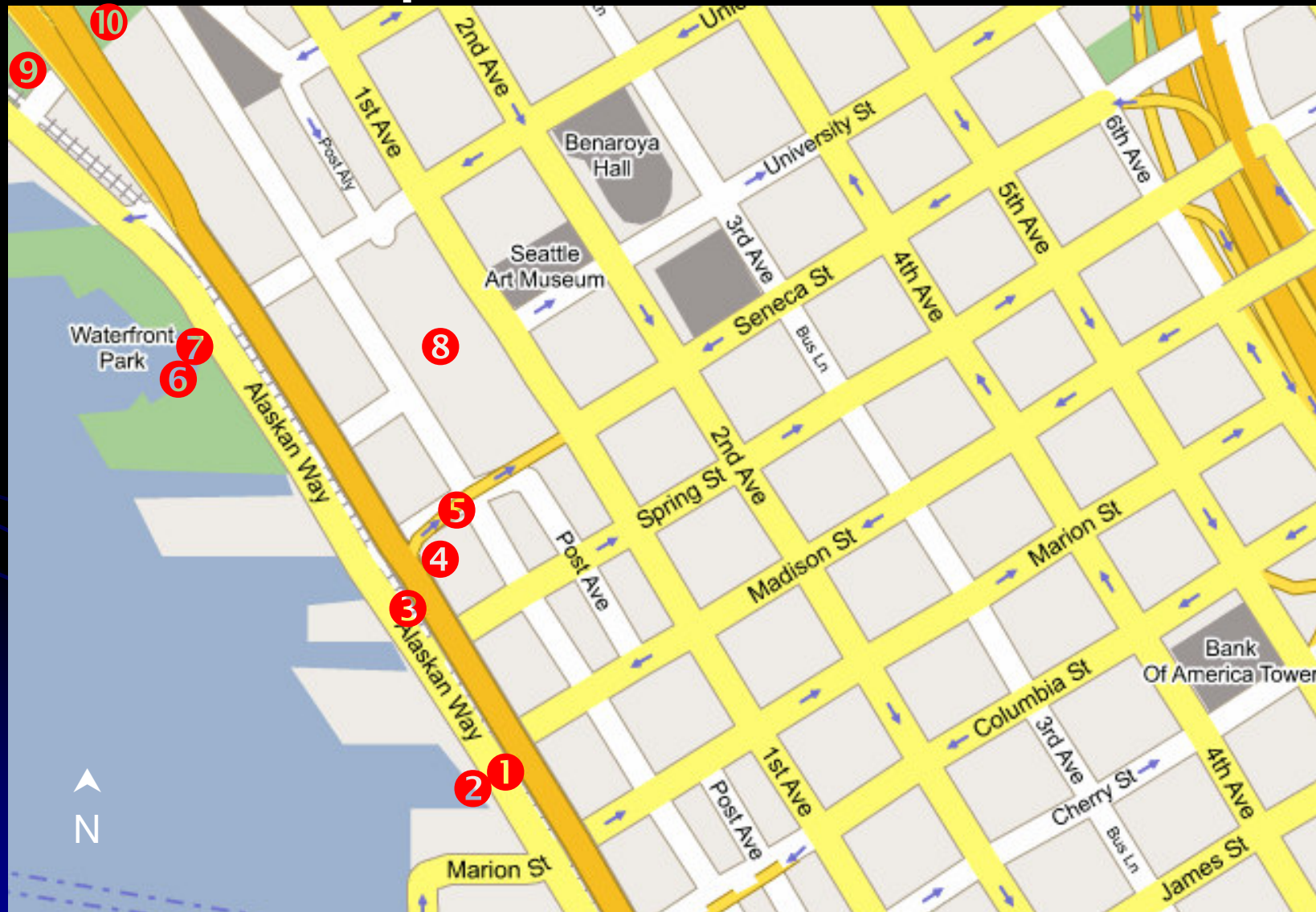


TNM Two-layer Roadway Modeling

- Create two roadways on-structure
- Identical horizontal coordinates
- Elevation of top deck 22 feet higher than bottom deck.



Comparison Locations



Modeled Compared to Measured



Model Under Predicts Reality

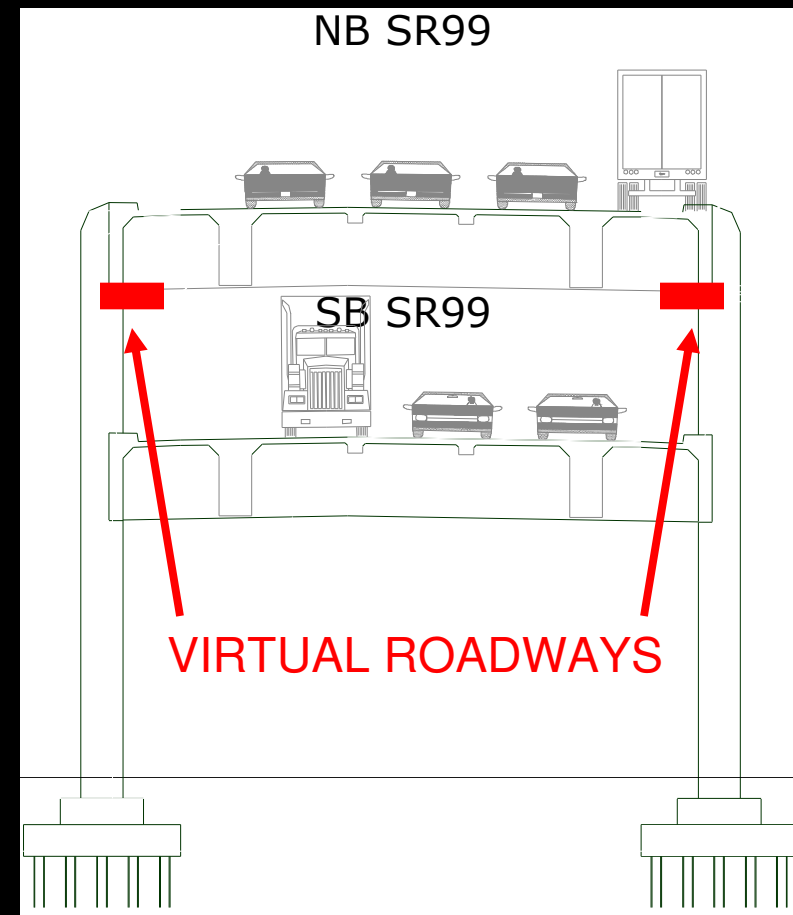
- TNM 2.1 under predicted noise levels by 7 dBA on average.
- TNM neglected noise generated by traffic traveling on the lower deck and reflecting off of the upper deck.
- The reflection is audible and substantially contributes to overall noise within 1 to 2 blocks from the viaduct.

Prior Work on Noise Reflections

- *Assessing Noise Reflections Off of the Underside of Elevated Bridge Structures: Procedures using the FHWA Traffic Noise Model*, Reiter & Bowlby, Transportation Research Record 1792, 2002.
- *Multi-Level Roadway Noise Abatement*, WSDOT 1992.

TNM Virtual Roadway Modeling

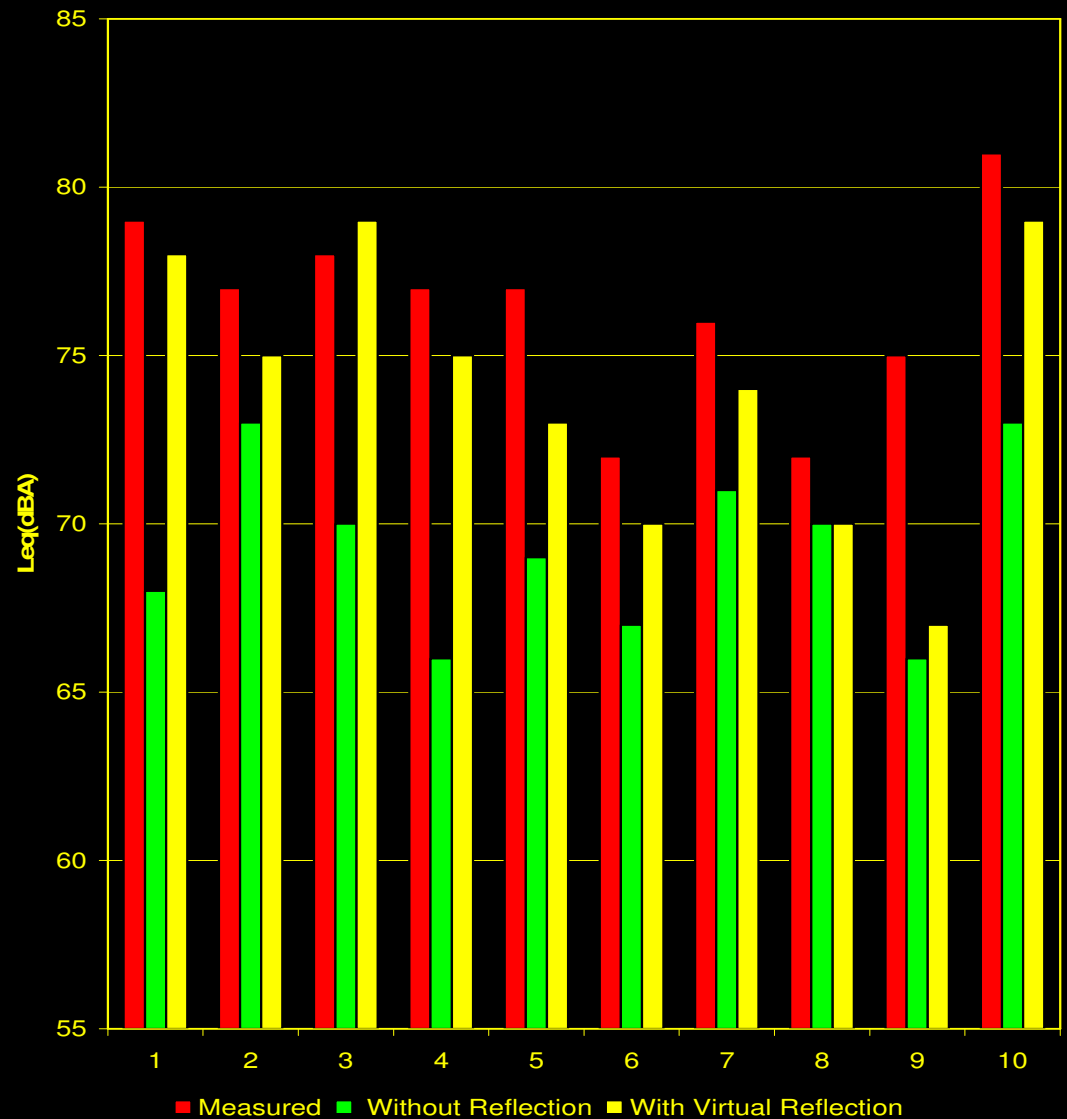
- Two “virtual” roadways were added
- Sized 1-foot wide
- Placed at bottom of upper deck
- Traffic for each virtual roadway was 50% of traffic on lower deck



Modeling Results with Reflection



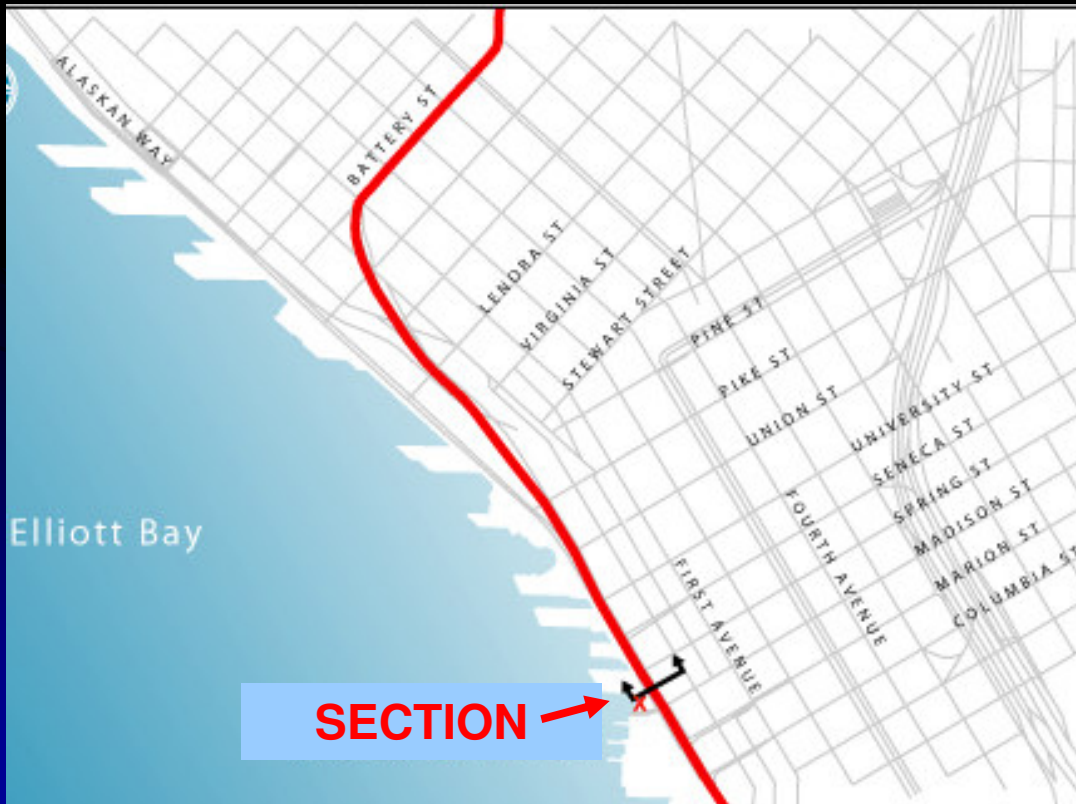
Modeling Results



Virtual Roadway Simulates Reflection

- Initially, TNM 2.1 under predicted noise levels by 7 dBA on average.
- With the virtual roadway added, TNM 2.1 under predicted noise levels by 2 dBA on average.
- The method is not reliable in areas transitioning to and from a double-deck configuration.

Noise Levels at one Cross-section



Modeling Results (Cross-section)



Modeled Reflection Observations

- At the edge of structure, virtual roadway reflection increases traffic noise level by 10 dBA, because direct roadway noise is shielded by the edge of the roadway deck.
- One-hundred feet from structure, the contribution of the reflection decreases to 2 dBA.
- The method is not reliable in areas transitioning to and from a double-deck configuration.

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